

THE SURGICAL TREATMENT OF PRIMARY RENAL
TUBERCULOSIS, WITH A CONSIDERA-
TION OF THE IMMEDIATE AND
REMOTE RESULTS AFTER
OPERATION.

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THE treatment of primary renal tuberculosis has now become, fortunately for our patients, almost entirely surgical in character, and, from the results which have followed in the more recent cases, this form of treatment can be considered as not alone promising good hopes of complete immediate recovery from the operation, but, if a proper study of the case has been made and the proper indications followed, a final and lasting cure.

As renal tuberculosis is, however, still considered as occupying the vague and undefined border-line between medical and surgical diseases, a comparison of the medical and surgical forms of treatment should be made before attempting to describe the methods and results of surgical treatment alone.

Post-mortem records answer in the affirmative the question as to whether or not healed renal tuberculosis is ever seen, so that in the first place we must admit its possibility. Madelung, of Germany, speaks of healed renal tuberculosis, and describes caseous tubercular nodules surrounded by a mass of dense fibrous tissue, as is seen in lung tuberculosis. He also describes a condition in renal tuberculosis in which the renal pelvis is invaded by sclerotic fatty tissue, with closure of the ureter, and apparent cessation of active inflammation.

Tuffier, Lancereaux, and Le Dentu, in France, describe a like condition, and in the same class may be placed several cases which are described by Michel ("Des tuberculoses latentes du rein." Thèse pour le Doctorat, Paris, 1897) under the name of latent tuberculosis of the kidney. He cites nine cases, but only two of these can be used as examples of healed tuberculosis, both showed atrophy of the affected kidney, and in both cases the kidney was surrounded by a mass of sclerotic fat, as described by Madelung.

David Newman ("Tuberculous Disease of the Kidney: Its Etiology, Pathology, and Treatment," *Lancet*, February 24, 1900) also takes up the question of the healing of renal tuberculosis and describes a case illustrating this form of termination. He found the "right kidney much atrophied from the tuberculous disease; it weighed one ounce, was embedded in a mass of adipose tissue, and in its upper extremity was a small cavity with smooth walls, of the size of a hazel-nut, filled with pultaceous material. Several other small cavities existed containing caseous matter. The left kidney was enlarged by compensatory hypertrophy and weighed seven and one-half ounces." He attributes this tendency towards healing, which is occasionally met with either to a marked resistance of some individuals to the invasion of the tubercle bacillus, or to the introduction into the kidney of bacteria weak in virulence and few in number.

L. Bolton Bangs makes another addition to the number of healed cases in an article entitled "The Remote Results after Operation for Renal Tuberculosis," appearing in the *ANNALS OF SURGERY*, January, 1898. He describes here a case which he considers as possibly cured, or at least that the disease is in a state of abeyance, and that no new foci have developed. This case can be classed with the other cases of healed renal tuberculosis, however, only from the clinical stand-point, and the author takes the precaution to say he considers his patient as still menaced by the presence of the tubercle bacilli in the renal tissues.

Under what conditions this healing occurs can only be

answered theoretically, by citing either unusual resistance of tissues or weak virulence of bacteria; and though many attempts have been made to treat renal tuberculosis by general measures calculated to strengthen the tissue resistance, or, by the use of various medicinal agents, to lessen the virulence of the organisms, the success thus far has been but slight. Therefore, though we are sure that the healing of renal tuberculosis is possible, yet, as we do not know under what conditions it takes place, we are no farther advanced than before this fact was proved, and cannot say that any particular case is suitable or unsuitable for its trial. The following case, which I had the opportunity of seeing, will give the general experience of most surgeons.

The patient was a young woman of about twenty-one, who had suffered for some months with frequency of micturition, and had had a few attacks of pain in one region. Tubercle bacilli were demonstrated in the urine, and catheterization of the ureters proved that only one kidney was affected. Her general condition was so good that it was considered a favorable case to attempt general medical measures rather than an immediate resort to the knife, and she was fortunately in such a financial position that she could command anything necessary. In spite, however, of every care, she became steadily worse, and six months later it became necessary, on account of the local condition, to resort to operation; and, though she did quite well afterwards, the operation was difficult on account of the adhesions around the kidney, and the convalescence was tedious because of her weakened condition.

The character of the tubercular inflammation, from a pathological stand-point, also seems to contraindicate any form of medical treatment, as the semimalignant character of the growth is immediately recognized when we consider the peculiar chronic type of inflammation with its slow but steady development, the constant destruction of tissue, the tendency to invade surrounding organs, and, finally, the early and widespread bacterial metastases. For this reason we must not be influenced by the conservative indications which are our guide in the usual type of renal inflammation, but, because of this

clinical relationship to true malignant tumors, must follow the rule laid down for the treatment of malignant growths, and advise early and complete removal as offering the best means of immediate and lasting cure.

In studying the surgical treatment, I wish to consider, first, the operations having for their object the palliation or cure of renal tuberculosis, and then from a collection of cases I will attempt to formulate reliable statistics as to immediate and remote results, which may serve as a guide to us in work along this line. I have used for these statistics the cases collected by Facklam (*Arch. für klin. Chir.*, Band xlv, page 715), those collected by L. Bolton Bangs (*ANNALS OF SURGERY*, January, 1898), and to them are added a number which have appeared in the literature, as well as quite a number of unpublished cases which I owe to the courtesy of Dr. Willy Meyer, Dr. C. P. Noble, Dr. W. W. Keen, Dr. R. F. Weir, Dr. C. B. Penrose, Dr. George Tuttle, Dr. Baldy, Dr. C. Fenger, Dr. H. A. Kelly, and Dr. W. S. Halsted, of the Johns Hopkins Hospital.

In considering the various operations advised in the treatment of renal tuberculosis, we must divide them into those which have merely a palliative effect in view, and those which are performed with the hope of effecting a final cure. In the first class is placed nephrotomy, this being the only operation which is frankly done with the idea of palliation alone, all others being made with the hope, at least, of effecting a cure.

The curative operations are nephrotomy, resection of the diseased portion of the kidney and nephrectomy, or removal of the entire kidney, to which last must be added nephro-ureterectomy, a distinct advance over nephrectomy alone, the improvement consisting in the removal of the diseased ureter with the affected kidney.

Nephrotomy as a palliative measure is of great value, as in the first place it relieves acute symptoms which could not be reached in any other way; and in the second place, it does not preclude radical treatment later, when the patient has recovered sufficiently to stand more severe operative measures.

The class of cases in which nephrotomy is most valuable are those where the disease has caused marked constitutional changes. Thus, a patient, with rapid feeble pulse, hectic type of temperature, much emaciated, and suffering from constant pain, the presence of a large renal abscess, and great weakness, can be relieved immediately, though temporarily, by evacuating and draining this abscess cavity.

These are the operations of necessity, or emergency operations; and it is in this class of cases that most marked temporary improvement is often seen. It is in this class of cases, too, that sometimes the apparently miraculous cures are made, as many of these patients are undoubtedly brought to so low a condition by a mixed infection, pyogenic organisms gaining entrance to the diseased area, with a resulting acute septicæmia. When the abscess is opened the acute symptoms rapidly disappear, and if the tubercular infection has not extended to other organs, a secondary nephrectomy will give final cure.

Another class of cases in which nephrotomy is indicated comprises the patients who, besides the renal focus, have foci of tubercular disease in other portions of the body, usually the lung or the other kidney.

Included in this same class are also the patients in whom there is another fatal disease of some one or more of the important organs, either a chronic nephritis of the second kidney, amyloid changes in the second kidney, spleen, or other organs, or other fatal disease.

Tuberculosis of the bladder with primary renal tuberculosis is an exception to this general rule, as it is not at all uncommon to find bladder tuberculosis clearing up after the removal of the affected kidney. This fact has often been noted, and I have personally seen it occur in several instances.

Still another class in which nephrotomy may be indicated comprises the patients in whom it is questionable whether they have the necessary strength to withstand the shock of a severe surgical operation such as nephrectomy, but in whom immediate relief of the symptoms is necessary. In these it is better, perhaps, to be on the safe side and perform a primary nephrot-

omy, planning later a secondary nephrectomy under better conditions, and with a better hope of cure.

This last group of cases is possibly the most difficult group in which to decide what is to be done, as my statistics show that nephrotomy followed by secondary nephrectomy is a somewhat more dangerous operation than the primary nephrectomy. The figures which prove this, however, give rise to a fallacy, as my figures include all the cases of nephrotomy followed by nephrectomy; and naturally the patients must for some reason have been unable to stand the primary nephrectomy, and therefore must have been weaker than those where primary nephrectomy was done. For this reason it is hardly fair to compare directly the two forms of operation; and when the dangers of each are considered, the only added ones which can be theoretically applied to the nephrotomy followed by nephrectomy, and not to the primary nephrectomy, are the effects of a second anæsthetization with its action on the other kidney, the somewhat longer time that the first mentioned form of operation gives for the extension of the tubercular disease, and probably in some cases a more densely adherent kidney to remove.

Nephrotomy is a comparatively simple operation and requires but few precautions beforehand. In making the incision, the precaution is taken not to traverse the peritoneal cavity, and having this in mind the incision is made over the most fluctuant and prominent point of the tumor.

Large tumors in the renal region naturally raise before them the peritoneum; and the incision, for this reason, can be made further forward than is usually safe. The guide to the position of the peritoneal cavity may be stated in these cases to be the resonance of the ascending or descending colon; and if this is found lying to the inner side of the tumor the incision may be made between the anterior and posterior axillary lines below the costal margin, if this is desired, though it is better to make it as far back as possible, both for the ease of dressing the wound later and because of the probability of a secondary nephrectomy. The direction of the incision makes but little

difference, as a hernia is rare in this position; though, as previously mentioned, it is better to have it as far back as possible, as the resulting fistula is more easily managed here than if it be situated in the side.

The incision is carefully carried down through the muscles, separating them with the finger, or with the knife, and tying any small vessels which may bleed. On reaching the kidney an incision is made through its wall with the knife, or, if the wall be thin, it can be torn through with the finger. The primary incision through the kidney tissue may also be made with the Paquelin cautery, if hæmorrhage is feared. After the pus is evacuated the opening in the kidney is torn larger, and the fingers introduced into the cavity to discover and break up any secondary or subsidiary cavities. These may be detected, also, by making a bimanual examination with one hand on the anterior abdominal wall in front of the tumor, and the fingers of the other hand in the tumor. When it is certain that all of the secondary cavities have been opened, the general cavity is thoroughly irrigated and packed with washed-out iodoform gauze, taking care that the gauze is carried to the bottom of the sac.

The after-treatment of these cases is usually simple, the gauze is slowly removed, and the cavity is then irrigated daily and repacked loosely. After the lapse of several weeks or a month the external wound will have contracted down to a small sinus leading to the bottom of the former sac, and secreting a profuse purulent material, possibly mixed with urine, if the kidney is not completely destroyed by the tubercular inflammation.

It is important that the drainage tract should not be allowed to close, for, if this happens, a purulent collection is sure to follow, and a recurrence of the former symptoms results.

Nephrotomy as a curative measure has also been advised, and an occasional case is reported as cured by this method. It is always doubtful, however, whether the renal disease in these cases was really tuberculosis or not, and in most of the so-

called cures the patients have passed out of observation soon after the operation. I can find but four cases in which a cure lasting for any length of time has been reported, and even in these there is some question as to whether they were really tubercular or not. Therefore, though I have classed nephrotomy as a curative measure, it seems doubtful whether it really should appear under this head.

Resection of a Portion of the Kidney.—This operation appears at first sight to be the acme of conservative surgery, and, if the results were only reliable, we could not have a more satisfactory method of treatment. It is indicated, and a most valuable method of treatment in some inflammatory infections of the kidney, but in tuberculosis it is a dangerous method. In spite of the dangers, however, it is occasionally done, and Max Wolff ("Die Nierenresektion und Ihre Folgen," Berlin, 1900) has collected nine cases of renal tuberculosis treated by resection of the diseased portion, or by curetting away of the same, which operation he considers as similar to the resection, leaving behind in both operations from one-third to two-thirds of the kidney.

In his monograph he seems to consider it a good method of treatment in selected cases, and on the first glance the results would seem to be good.

On considering his cases, however, but two out of the nine gave entirely satisfactory later results,—one, reported by Israel (*Freie Vereinigung der Chir.*, Berlin, 1896-97), was well one year later, and the other reported by Morris (*The Hunterian Lectures on the Surgery of the Kidney, British Medical Journal*, March 26, 1898) was well two years later. Two other cases were reported as cured on leaving the hospital, and of the remaining, one was found to have tuberculosis of the other kidney, one was operated on at the same time for tuberculosis of the testicle, which would point to other foci of tuberculosis in the body, and three died; one of these, five hours after operation, and two at a later period, one from broncho-pneumonia, the other from general tuberculosis.

The chief danger is due to the peculiar insidious develop-

ment of the tubercles, which in the first stages are not visible to the naked eye; and for this reason it is always uncertain whether or not all of the diseased tissue is removed. Besides this, small foci of disease may be deeply hidden in the depths of tissue which on the surface appears normal.

I have seen several examples in which at first sight only a portion of the kidney appeared diseased, but which on careful pathological examination showed either discrete microscopical tubercles in the apparently healthy kidney, or in which there were small abscesses situated deeply in the renal substance, and not appearing until sections in various directions through the kidney had been made. These facts seem to me to be a direct contraindication for resection of the kidney in renal tuberculosis. König in a late article ("Die Chirurgische Behandlung der Nierentuberkulose," *Deut. med. Wochenschrift*, February 15, 1900) expresses the same view in regard to resection of the kidney for this disease, considering it a highly dangerous procedure.

The operation consists in exposing the kidney and bringing it out of the wound as is done in nephrectomy. The diseased portion is marked off from the healthy tissues and removed with the knife or cautery, cutting through tissue which appear to be normal. The raw surfaces are brought together by sutures and the wound drained or closed. In the resection it is well, if possible, to make a V-shaped incision through the kidney, that the raw surfaces may be more easily coapted. Hæmorrhage is usually not troublesome, and can be controlled by suture. The cautery is not usually advisable, as the separation of the eschar may be followed by hæmorrhage.

Nephrectomy or Excision of the Kidney.—This is our most valuable operation in dealing with primary renal tuberculosis, and may be done either as the primary operation or may follow a primary nephrectomy, as the curative measure, when the nephrotomy has failed to give relief.

Primary nephrectomy is indicated in all cases in which one kidney alone is diseased, though this must be qualified by stating that there must be no discoverable tubercular foci in

any other important organ, save the bladder or ureter of the same side. As another possible exception to this rule may be classed the cases in which a small tubercular area in one lung has been demonstrated, the patient being otherwise in good condition, as occasionally such a patient under proper hygienic and climatic conditions will to all appearances regain complete health.

The indications for a secondary nephrectomy after nephrotomy are not so plain; the usual indication appears to be a persistent or troublesome fistula, which shows continued development of the tubercular disease. Another strong indication for secondary nephrectomy is change for the worse in the general condition; for example, the patient, after apparently improving for a time following the incision and drainage, begins to lose strength and flesh, or the temperature begins to vary, and in such cases nephrectomy is indicated.

Nephrectomy may be performed in several ways,—the operation may be extraperitoneal or transperitoneal, the pedicle may be ligated or clamped, or the kidney may be shelled out of its capsule, leaving the capsule in position. Besides these, nephro-ureterectomy, or removal of the ureter with the kidney, may be done, or the operation may be still more extensive, and a portion of the bladder be removed with the kidney and ureter. The indications for and against these modes of operation depend partly on the personal preference of the individual surgeon, though some general rules may be laid down as guides.

The chief objection to the transperitoneal form of nephrectomy is, that the peritoneal cavity is opened, with its attendant danger of peritonitis added to the shock of the kidney removal; and, though this is not a frequent cause of death, it has repeatedly occurred in transperitoneal nephrectomy. On the other hand, the transperitoneal operation gives somewhat more space for the necessary manipulations. The lumbar or extraperitoneal nephrectomy does away with the danger of peritonitis, though the peritoneum even in these cases is sometimes opened accidentally during the operation. The amount of room which is obtained in the lumbar nephrectomy is some-

what less than the transperitoneal method, and for this reason large tumors are removed with greater difficulty. The general rule may be laid down, however, that it is safer, if possible, to attack the kidney by the extraperitoneal method, and, if necessary, more room can be obtained by the resection of a rib, or by auxiliary incisions. This is especially true if a mixed infection is supposed to be present, as the most frequent cause of peritonitis seems to be a rupture of such an abscess, with the escape of the purulent material into the peritoneal cavity during operation.

The incision made depends, as does the choice of operation, greatly on the individual preference of the surgeon. In the extraperitoneal nephrectomy the incision giving most room is one beginning at the outer border of the quadratus lumborum muscle just beneath the twelfth rib, and extending from here obliquely downward and forward along the crest of the ilium. A method advised by Morris, which consists in separating the muscles with the finger instead of cutting through them as is usually done, may also be tried if the kidney be small. The skin incision for this last method is quite a long one, and after the skin, fat, and fascia are divided with a knife, it is laid aside, and with the fingers a hole is torn through the muscular layers, taking care that the tear is in the direction of the muscular fibres. In this way the muscle is not cut, and, even more important, one avoids cutting the cutaneous branches of the spinal nerve which give sensation to the skin over the flank and buttock.

The incision for the transperitoneal nephrectomy may follow closely the curve of the costal margin, may be made obliquely from the edge of the quadratus lumborum muscle, forward and downward to the anterior superior spine, or it may be made through the anterior abdominal wall in the middle line, or at the outer edge of the rectus muscle. If these incisions do not give space enough for the necessary manipulation, they can be enlarged by auxiliary incisions at right angles to the primary one.

When the kidney is reached, it is carefully separated from

the surrounding tissues, taking care in the separation that no auxiliary or abnormal branch of the renal artery is cut.

These abnormalities are quite frequent, and it is common to find a branch coming off directly from the aorta to the upper or lower pole of the kidney, or if not from the aorta, a like branch may be given off from the renal artery and enter the kidney in the same position. Special care must be taken in freeing the two poles, as at these points adhesions are most apt to be dense and firm. After the kidney is freed the next step is the treatment of the pedicle, and naturally the safest method is to isolate and tie separately all the renal vessels. This is difficult in many cases, however, as there is a mass of fat usually surrounding the renal pelvis and vessels which is apt to be dense and hard because of the inflammatory condition. In such cases the pedicle will have to be ligated either *en masse* or in several portions, which can be done by passing an aneurism needle through the centre of the pedicle, working it between the vessels, and tying in both directions.

For this class of cases, a heavy artery clamp, which is placed in position and left on the pedicle for from twenty-four to forty-eight hours, has been advised. Some surgeons have obtained good results in this way, never having had any trouble with the clamps. Several cases of severe hæmorrhage, however, after removal of the clamp, stamp this method as rather a dangerous one, and a ligature is certainly a more satisfactory means of treatment.

Nephro-ureterectomy.—After the removal of the kidney, the next question that arises is what shall be done with the diseased ureter. A French surgeon, Reynier (*La Semaine Médicale*, February 24, 1893, Vol. i, No. 8), first answered this question by removing a tuberculous ureter some months after the removal of a tubercular kidney, and since this time quite a number of somewhat similar operations have been done with complete success. Dr. H. A. Kelly reports in *The Johns Hopkins Bulletin* of February to March, 1896, three cases of nephro-ureterectomy for renal tuberculosis; and since that time (March, 1896) several like operations have been done at

the Johns Hopkins Hospital with equally good results. Only one of these cases was followed by a persistent fistula, and it was due in this case to a deeply buried silver-wire suture.

Nephro-ureterectomy may be performed either transperitoneally or extraperitoneally; though the extraperitoneal route is as convenient and much safer than the transperitoneal one. The incision is begun at the external border of the quadratus lumborum muscle just beneath the twelfth rib, and curves downward and forward along the crest of the ilium to a point above the anterior superior spine, then downward and parallel to Poupart's ligament.

We have evolved in doing this operation several points which are of considerable importance, and which lessen somewhat the danger. In the first place, instead of making the incision continuous throughout its whole length, the usual oblique incision in the renal region sufficiently large to allow a separation of the kidney, renal pelvis, and upper portion of the ureter is made, and the kidney carefully separated and the vessels ligated. Another incision is then made about eight centimetres in front of the lower point of the first, extending along the crest of the ilium, and after the muscles are cut through the peritoneum is loosened, pushing it inward towards the median line. Then by pulling on the kidney in the other incision the ureter can be distinctly felt as it tightens over the muscle. When the ureter is located, the kidney and upper portion of the ureter may be pushed under the bridge of muscle left, or the ureter may be tied in two places, divided between, and only the divided lower portion pulled under the bridge of tissue. After this is done, it is easy to follow the ureter in the iliac fossa to where it crosses the brim of pelvis and downward to its entrance into the bladder, pulling on it and freeing the tissues around it as one advances. The uterine artery will have to be tied where it crosses the ureter, but otherwise no important structure need be disturbed.

Several plans have been advised to get rid of the portion of the ureter left at the bladder, and the most satisfactory would seem to be a removal of the portion of the bladder

through which the ureter passes, closing the bladder wall by two layers of sutures. If this cannot be done, the portion of the ureter may be brought down and pulled through an opening in the vaginal vault, where it is fastened. Drainage is necessary after this extensive operation; and it is most satisfactory to place drains both from below, through the vaginal vault in the female, or through the lower angle of the wound in the male, and from above through the kidney wound, the rest of the incision being firmly closed by several layers of interrupted sutures.

The chief points in this form of nephro-ureterectomy are the bridge of muscle tissue left undisturbed strengthening the abdominal wall, the removal of the entire ureter, with possibly the adjacent portion of the bladder, and the extraperitoneal route of the operation.

The question as to what becomes of a tubercular ureter if it is not removed with the kidney is still somewhat doubtful. It is probable that the persistent fistula which follows in so many cases of nephrectomy for tuberculosis may be due to the ureter left *in situ*.

A. B. Johnson (ANNALS OF SURGERY, 1899, Vol. xxix, page 754) describes the later condition in a case in which the kidney was removed sometime previously for renal tuberculosis. In this case the ureter was found much thickened at the first operation, and a persistent fistula remained after it. At the later operation the ureter was found to have almost entirely disappeared, being represented by a thin fibrous cord, containing at intervals three or four beads about the size of buckshot, which on incision gave vent to a material resembling axle-grease, partly cheesy in character. F. Tilden Brown (ANNALS OF SURGERY, 1899, Vol. xxix, page 755) spoke of having seen a similar case in which he removed a tubercular kidney, leaving the ureter behind. The patient died some months later, and at the autopsy, the ureter, which at the time of operation was enlarged to about the size of the thumb, had diminished fully one-fourth in size, though tubercle bacilli were still present. From these cases, Brown

considers that non-functionating tissue, as the ureter must be after the kidney is removed, resists more strongly the growth of the tubercle bacilli, and that final cure may follow. Several other surgeons spoke of having seen like results in cases in which the ureter was not removed; and though these reports do not prove anything definite, still, they rather tend to show that in some cases, at least, a tubercular ureter left in the body is able to take care of itself, and will resist further extension of the tubercular inflammation, finally becoming a fibrous cord in which no definite tubercular structures can be found. This would account for the cases which, after having been troubled with a persistent fistula for several years, are finally entirely cured.

That this favorable result does not, however, always follow is evidenced by several cases reported by Dr. McCosh (*ANNALS OF SURGERY*, 1899, Vol. xxix, page 757). One of these was operated upon three years before, a tubercular kidney being removed. Two years later an abscess developed near the site of the ureter, which was opened and scraped, healing temporarily. Later, a second abscess appeared lower down, and McCosh expected to have to remove the diseased ureter later. In another case he removed, one year later, a tubercular ureter as thick as a man's thumb, filled with tuberculous granulating material, and in still another case, a persistent fistula remained behind, through which methylene blue could be injected into the bladder. Dr. H. A. Kelly has had a similar experience with a patient from whom he removed a tubercular kidney, and had later to remove the ureter for continued vesical and ureteral tuberculosis.

These cases show that we cannot always depend upon the non-functionating ureter taking care of itself, and prove that when possible ureterectomy in addition to the nephrectomy is necessary, as we can never be sure that the ureter will not give trouble later.

TABULATED RESULTS AFTER OPERATION.

I have collected 304 cases of renal tuberculosis in which some operative form of treatment has been followed, the opera-

tions comprising nephrotomy, nephrotomy followed by nephrectomy, resection of the diseased portion of the kidney, and primary nephrectomy, or, in fact, every form of surgical treatment advised for renal tuberculosis. From these the following statistics have been compiled.

I have in these statistics placed the deaths after operation in two divisions, those occurring within one month being considered the immediate deaths, while those occurring later than one month are considered as the remote results.

Nephrotomy not followed by any other operation was done in fifty-five cases. Among these, fifteen died within the first month after operation; twenty-two died at a later period, varying between two and one-half months and three years; eight were noted as improved at the time of reporting the case, and ten were noted as recovered. In six out of the ten it was extremely questionable whether the patient was really suffering from a renal tuberculosis; and it is probable, from the symptoms and condition, that the inflammation was rather a pyelonephritis or pyelitis from other causation. This leaves but four out of the fifty-five in which complete recovery could be claimed. Of these four, one had remained well for three years, another for three months; the third was noted as a recovery "*per primam*," with no note of the final result, and the fourth case was lost sight of soon after the operation.

The cases of death within one month were of interest. Out of the fifteen, two cases were reported in which the cause of death was not stated; this leaves but thirteen, among which two died of septicæmia, six of uræmia, the second kidney being involved in the tubercular process; two from peritonitis following the rupture of a perinephritic abscess; one from amyloid disease of the other kidney, and two from disseminated tuberculosis.

Among the twenty-two cases which died at a later period than one month the cause of death was not stated in nine, which leaves thirteen to be accounted for. Among these both kidneys were tubercular in six; one had amyloid disease of the

second kidney; two died of general miliary tuberculosis, and four of pulmonary tuberculosis.

Among the eight noted as improved, one suffered from cavities in the lungs; another from tubercular abscesses in other portions of the body; two had persistent fistulæ; another complained of pain and vesical tenesmus; in one the other kidney was involved in the tubercular disease, and in two no definite cause was given for classing them as improved. Thus, out of fifty-five nephrotomies not followed by other operation, we find but four in which recovery can be claimed, and in but one out of these four did the recovery certainly last for any length of time. These results seem to class nephrotomy almost entirely as a palliative rather than as a curative operation.

I have collected 191 cases of primary nephrectomy, of which 106 are noted as followed by complete cure, lasting from one month to twelve years; thirty-one were improved by the operation, thirty-seven died within one month after the operation, and seventeen died at a period later than one month. As cures, only those cases are classed which presented no later symptoms of bladder involvement or of disease in other portions of the body. The duration of the cure varied from a period of two months after operation to a period of twelve years; this last being the longest time that I could find, and is reported by König in his recent article on the surgical treatment of renal tuberculosis.

On examining these figures more closely, it is found that of the 106 cures the duration is not noted in twenty-six, leaving eighty in which the duration is definitely stated. Of these twenty-five remained cured over two years; twenty-one over a year, and thirty-three between one month and a year. Among the thirty-one cases classed as improved we find eight who were only suffering from a persistent fistula, which had lasted from one month to twenty-four months, the patient otherwise being well. It is probable that among these a certain number could later be classed as cured, for sometimes the fistula heals at a late period, due either to the slow fibrous change in the ureter, or, as occasionally happens, to the removal of a

ligature or suture deep in the wound. In one case, besides a persistent fistula, the patient had tuberculosis of the bladder which resisted any form of treatment. In seven cases symptoms were given which indicated probable tuberculosis of the second kidney,—though this could not be certainly determined,—and some of them had lived perfectly comfortable for four or five years after the operation, in one especially the only suspicious occurrence being an occasional attack of hæmaturia. Certain tuberculosis of the second kidney, which would undoubtedly be fatal sooner or later, was present in three patients; four suffered from tuberculosis of the lung, and three from persistent tuberculosis of the bladder.

In the 191 cases of primary nephrectomies there were fifty-four in which death was the result, thirty-seven dying within a period of one month and seventeen at a later period, varying between forty-five days and three and one-half years. Among the thirty-seven patients dying within one month, fourteen did not survive longer than forty-eight hours, the remaining twenty-three living from forty-eight hours to twenty-three days.

These thirty-seven, or nineteen of the whole number, may be considered as comprising the immediately fatal cases; and when it is remembered that these 191 nephrectomies for renal tuberculosis comprise practically all that have been performed, beginning with the earliest case, when the operative technique was much less advanced than at present, the percentage seems indeed a lower one than might be expected.

That this percentage can be made still lower in the future is proven by a study of the causes of death which follows.

TABLE I.
CAUSES OF DEATH WITHIN A PERIOD OF ONE MONTH.

Uræmia	9
Tuberculosis of other kidney.....	3
Amyloid degeneration of other kidney.....	2
Collapse or shock.....	5
Peritonitis	4
Septicæmia	3
Hæmorrhage	2

Exhaustion	2
Carbolic acid poisoning.....	1
Necrosis of gut.....	1
Ulceration of bladder (septicæmia).....	1
Cause of death not stated.....	4
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It will be seen from the above table that nine cases are noted as dying from uræmia, that three more had tubercular disease of the second kidney, and that in two more there was amyloid degeneration of the second kidney; thus fourteen out of the thirty-seven died within one month from disease of the second kidney, and all most probably from uræmia. With our present means of determining the condition of the separate kidneys, death from tubercular or amyloid disease of the kidney left in the body should not happen, so that we may count out the last five, having nine where the cause of the uræmia was not stated. There are a few cases reported in which complete anuria, probably of reflex origin, have followed removal of one kidney when the remaining one appeared healthy, and this might have occurred with some of these. It is natural to suppose, however, that the uræmia in these cases also followed tubercular or amyloid changes in the second kidney, or at least chronic nephritis, any of which might be discovered by a careful study of the separated urines.

It is necessary, too, that we consider nephrectomy for renal tuberculosis in these cases from two points of view. Naturally, in the first place, nephrectomy is practically always done as a life-saving operation, and from this stand-point the fourteen cases were failures. In the second place, however, it must be realized that all of these fourteen patients were probably affected by fatal disease of the second kidney, and that the death was only hastened by the operation, and would have certainly followed, even if no operation had been done, in a short space of time, and therefore, though the operation was not successful in saving life, it must only be taken as hastening the certain death.

Collapse or shock was the cause of five deaths; and these

were probably the cases in which a nephrotomy, followed at a later period by nephrectomy, would be indicated, rather than the primary nephrectomy, as the patients were most probably in a much debilitated condition.

Peritonitis was the cause of death in four cases, and may be ascribed to faulty technique. The operations were transperitoneal, and in most of them rupture of the purulent sac probably occurred during the nephrectomy, with infection of the peritoneal cavity by forms of pyogenic organisms which are sometimes present as a mixed infection.

The extraperitoneal method of removing the kidney lessens to a great extent this danger, though even the extraperitoneal method does not prevent accidental wounding of the peritoneum and peritoneal infection.

Septicæmia cannot be avoided always; and when we consider the lowered resistance of the patient following the tubercular disease, the lessened power of eliminating toxins, as only one kidney is functioning, and, finally, the large wound into which various infectious organisms may be poured from rupture of the nephritic abscess, there does not seem a very large percentage of deaths from this cause.

Hæmorrhage can always be avoided by using sufficient care in securing the pedicle, taking the precaution that the pedicle is long enough to allow a good hold to the ligatures, and, finally, that all abnormal vessels are securely tied. In using the clamps to secure the pedicle, a hæmorrhage is always possible; and for this reason it hardly seems advisable, as the clamps may slip; it may cut through the tissues, or a firm clot may not have formed, and the pressure may force it out when the clamp is removed in twenty-four or forty-eight hours.

Exhaustion should probably be classed with collapse or shock, but as I found two with this cause of death, they were classed as such.

Carbolic acid poisoning, which probably caused death in one case, need not be considered as a cause of death now, as carbolic acid is so rarely used, and this case occurred in the days when carbolic acid was the chief antiseptic reliance.

The two other causes of death—necrosis of the gut and septicæmia from a deep ulceration of the bladder—could not be guarded against, and might happen at any time.

The study of the causes of death following operation are open to so many fallacies, and depend so greatly on the personal equation of the individual surgeon, that it is generally a difficult task to glean any very reliable statistics from them, and leaves the student with many important questions still unanswered. In the first place, it is easy to state that with the present means of diagnosis it is never necessary to remove one kidney before the condition of the second one has been determined, and thus fourteen deaths from uræmia after the nephrectomy might have been avoided.

This is a most optimistic statement, and only to be hoped for in the future utopia of perfect surgery, when all of our instruments of diagnosis are absolutely correct, when every ureter can be catheterized with certainty, and when our deductions from the obtained results are beyond criticism in every way. This perfection will not, unfortunately, be ours for many years to come, and for the present we must be thankful for the wonderful advances already made, which will certainly place the future death-rate from uræmia after nephrectomy at a much lower figure than fourteen out of thirty-seven deaths, or 38 per cent.

In criticising the other cases of death, several striking instances in which improvement might be made can be seen. Four deaths from peritonitis is a large percentage, and should be improved on; the chief point being the indication for the extraperitoneal method, if this be possible.

Hæmorrhage and septicæmia might also have been avoided, certainly in some cases, by care during the operation, avoidance of the clamp method for control of the vessels, and careful cleansing of the wound; and though shock and collapse are sometimes unavoidable, still, it would seem better judgment, in cases in which it might be expected, not to attempt immediately the nephrectomy, but relieve the immedi-

ate symptoms by incision and drainage, to be followed later by nephrectomy.

At any rate, from a careful study of the cases, I feel justified in prophesying better and better results, and a steady lowering of the death-rate as advances are made in diagnostic technique and operative ability.

A review of the cases of death at a later period develop also several interesting points.

TABLE II.

DEATHS AT A LATER PERIOD THAN ONE MONTH AFTER OPERATION.

Pulmonary tuberculosis.....	5
Tuberculosis of the second kidney.....	2
Tubercular peritonitis.....	1
Tubercular meningitis.....	1
Intestinal tuberculosis.....	1
Bladder and intestinal tuberculosis.....	1
General tuberculosis.....	1
Anuria from calculus, second kidney also tubercular.....	1
Pyelonephritis.....	1
Scarlet fever, kidney seat of acute nephritis, not tubercular	1
Acute peritonitis, probably suppuration around second kidney	1
Exhaustion	1

In the first place, the number of deaths, twelve out of seventeen, from tuberculosis in other parts of the body is striking, and points to a careless examination of the patient before the operation, for tubercular foci in other organs demonstrate the fact that an apparently primary tuberculosis is often secondary to a concealed focus in other organs, or that occasionally bacterial metastases take place very early in the course of the renal disease. Another point which the table illustrates most happily is the perfect ability of one kidney to carry on the body work, if it be healthy; for in searching the table but five deaths are noted as due to the kidney condition. Of these, two were due to tubercular disease of the second kidney, a third followed complete anuria from blocking of the ureteral orifice by a renal calculus, and in this one the kidney was also tubercular, one other died of pyelonephritis apparently not tubercular in character, and the fifth death fol-

lowed scarlet fever three years later, the kidney showing the lesions of acute nephritis but not tubercular, and, really, this last case should be classed among the cures.

A sixth death may also be attributed to the kidney, as one patient died of an acute peritonitis apparently following rupture into the peritoneal cavity of a perinephritic abscess.

Still another thing which seems important is the comparatively small number of deaths, seventeen out of 191, or about 8.5 per cent., at a later period than one month, showing that the prognosis for final cure is extremely good after the immediate results of the operation are over.

In my tables there are forty-nine cases of primary nephrotomy followed at a later period by nephrectomy; among these twenty-three are classed as cures; seven were either much improved or improved; one was not improved, and eighteen died within one month or at a later period. Among the twenty-three that are classed as cured the duration of cure was not stated in five, leaving eighteen among whom the period of cure extended from one month to seven years. As in primary nephrectomy, I class as cured only those cases in which no symptoms were complained of after the operation. Among the seven which were noted as improved, four suffered only from a lumbar fistula; and it is reasonable to suppose that one or more of these will finally be cured. One out of the seven improved cases had tuberculosis of the lungs, and another showed albumen in the urine, with the probability of the second kidney being tubercular. Out of the eighteen deaths eleven took place within one month, the time varying from two to twenty-eight days, with about the same causes that are seen following primary nephrectomy. Uræmia was noted in two cases, nephritis in one case, and tuberculosis of the other kidney in one case, so that four out of the eleven probably died of uræmia. Perforation of duodenum caused death in one case; in one case there was fatal hæmorrhage following the removal of the clamp on the renal pedicle; one case died of exhaustion following operation, and one case of general

miliary tuberculosis, leaving three cases in which the cause of death was not stated.

The late causes of death, also, were due, as in primary nephrectomy, chiefly, if not entirely, to tuberculosis of other organs, two dying of pulmonary tuberculosis, one of tuberculosis of the second kidney, and the others of miliary tuberculosis.

The results of the nine cases of resection of the kidney have already been noted, and I will only recapitulate them here.

Among the nine cases there were two recoveries enduring respectively one and two years; two others were reported as cures on leaving the hospital, though they were lost sight of at that time. Of the remaining five, one developed tuberculosis of the second kidney, one had had an operation for tuberculosis of the testicle, and three were dead, one dying five hours after the operation, and two at a later period, one from lung complications, the other from general miliary tuberculosis.

From the study of the individual cases, and from the statistical figures based on these, I feel justified in formulating the following conclusions:

(1) That renal tuberculosis may be classed as a semi-malignant form of inflammation, and that for this reason surgical treatment of some sort is always indicated.

(2) That this surgical treatment will have a palliative or a curative end in view depending on the condition of the patient and the duration and extent of the disease.

(3) That nephrotomy in renal tuberculosis is to be classed as a palliative operation; and that as a palliative operation for the immediate relief of dangerous symptoms, and as not precluding a later nephrectomy, nephrotomy with drainage of the abscess cavity is most valuable.

(4) That resection of the diseased part of the kidney is contraindicated in renal tuberculosis because of the danger of leaving a tubercular focus in the portion left in the body.

(5) That nephrectomy or nephro-ureterectomy is indicated in every suitable case, and in suitable cases should be followed by a lasting cure in 55.5 per cent. of the cases.

(6) That the indications against nephrectomy are tubercular or other disease of the second kidney, or tubercular foci in other organs.

(7) That tuberculosis of the bladder is not to be considered a contraindication to nephrectomy, as it will probably heal later.

(8) That a small tubercular focus in the lung, if the patient otherwise is in good condition, may sometimes not be considered a contraindication.

(9) That in doubtful cases, when it is questionable whether the patient can stand an immediate nephrectomy, it is better to do a nephrotomy, following it later by nephrectomy.

(10) That the clamp method of controlling the pedicle is contraindicated from the danger of hæmorrhage after the removal of the clamp.

(11) That it is safest to remove the ureter with the kidney, as a persistent fistula may give trouble if it be allowed to remain in the body.

(12) That a certain proportion of these fistulæ will finally disappear, either after the removal of a deep suture, or because of the slow disappearance of the tubercular disease in the ureter, which in these cases gradually changes into a fibrous cord.

(13) That we may expect a steadily increasing number of final cures as our means of diagnosis improve, and as our surgical technique is carried out more carefully and scientifically.